

Planning for Cap Design and Construction during the RI/FS

Case Studies from Region 10

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Objectives

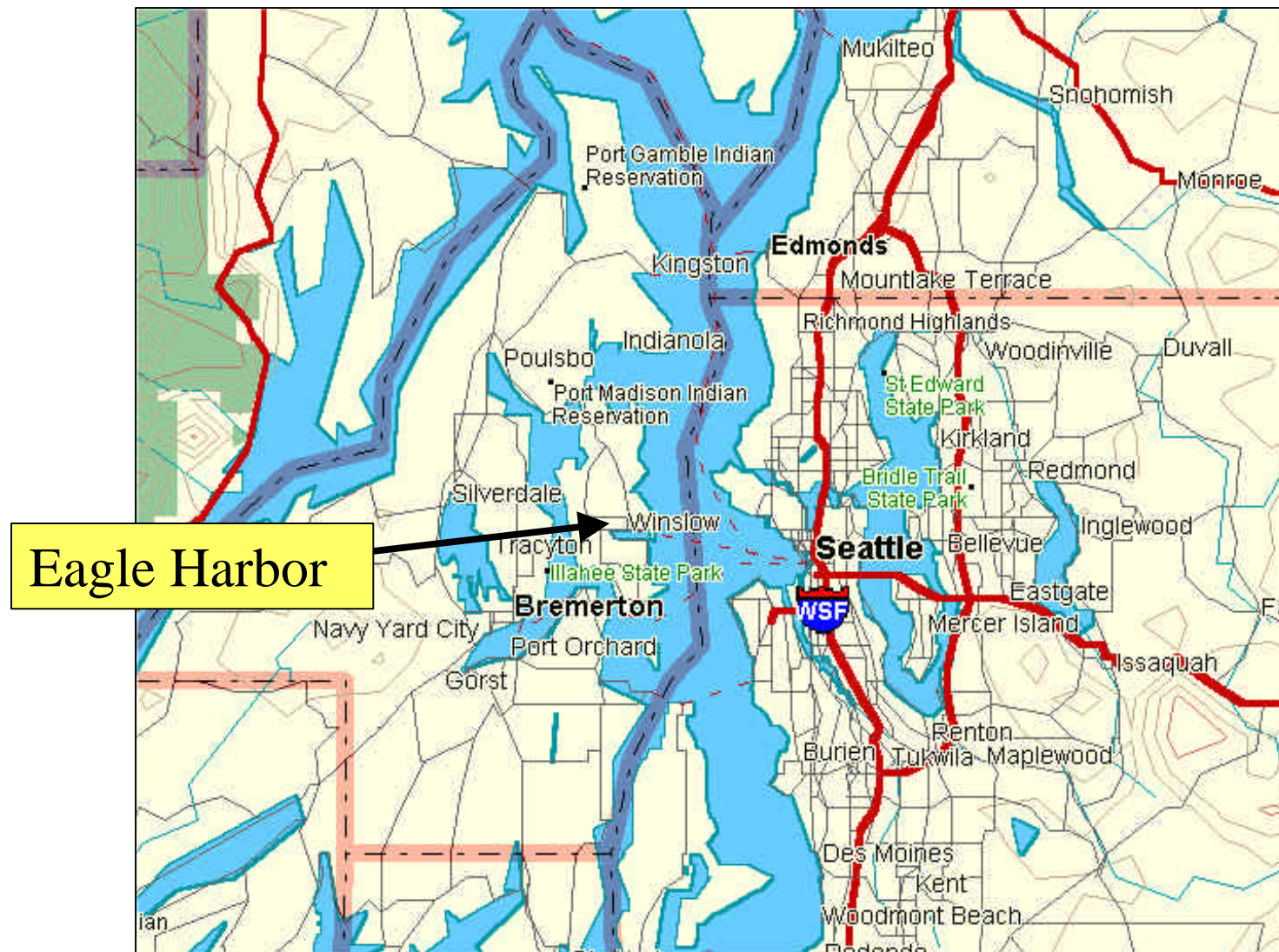
- Present Information on How to Plan for Cap Design and Construction during the RI/FS
 - Describe types of design-related data that can be collected during the RI/FS
 - Describe data usefulness for improving remedy selection and remedy design
- Present 3 case studies, identifying key parameters leading to success and summarizing long-term monitoring results

Outline

- Three case studies
 - St. Paul Waterway - kraft pulp and paper mill
 - Wyckoff/Eagle Harbor - wood treater
 - Ketchikan Pulp Co (KPC) - sulfite pulp mill
- Approach
 - Challenges
 - Solutions
 - Success Story
- Recommendations for RI pre-cap parameters



Location of St. Paul Cap, Tacoma, WA



Location of Wyckoff Cap, Eagle Harbor, WA



Location of KPC Cap, Ketchikan, AK

Risk Drivers and Selected Remedies

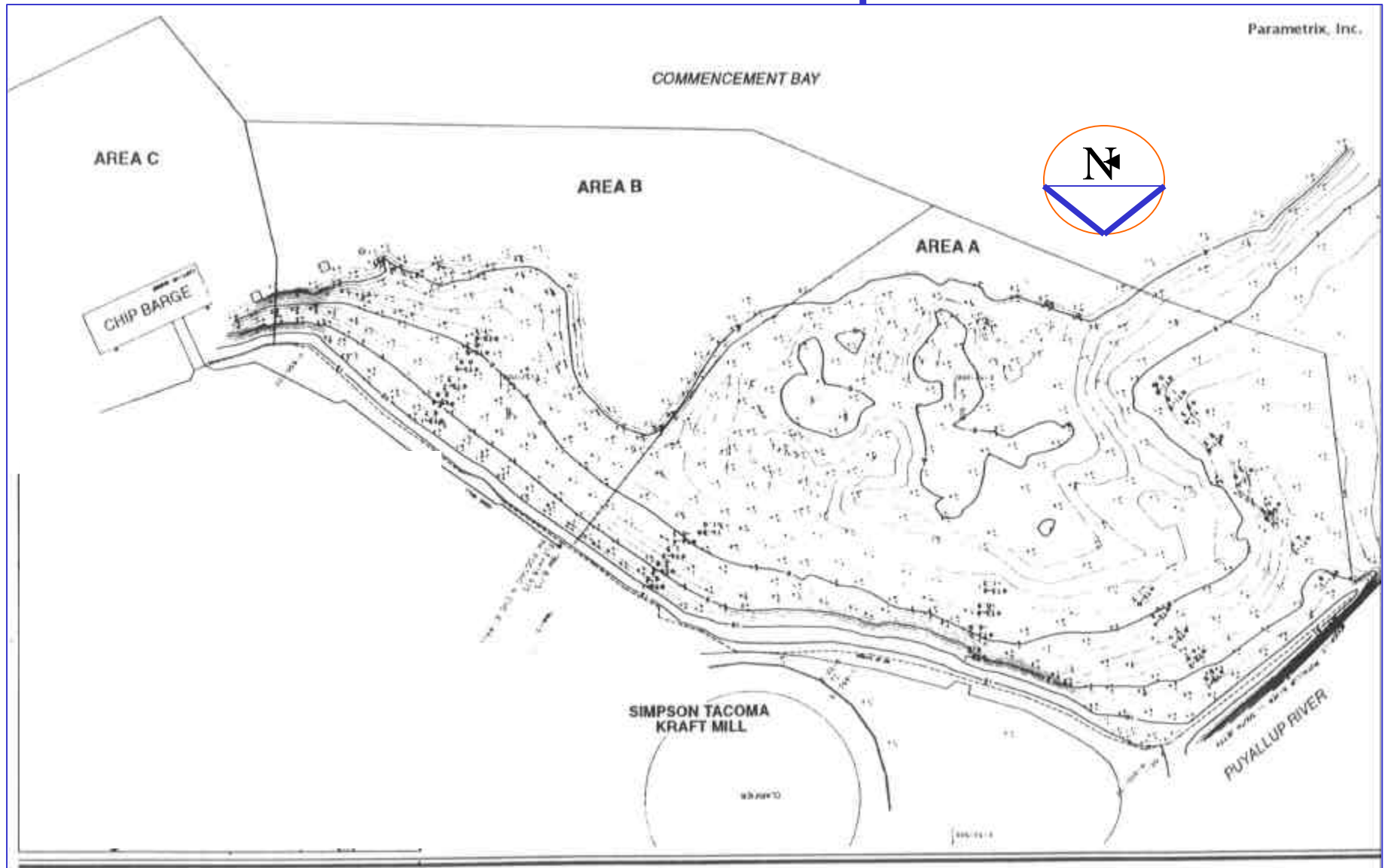
<i>Site</i>	<i>Risk</i>	<i>CoC</i>	<i>Acres</i>	<i>Remedy</i>
St. Paul	Benthos	Many	17	Full cap (4 to 20 ft)
Wyckoff	Benthos, Humans	PAH, Hg	69	Full cap (2 to 15 ft)
KPC	Benthos	Ammonia HS ⁻ 4-Methyl- phenol	27	Thin Layer Placement (6 to 12 inches)

Cap Completion

- Sediment cap (isolation)
 - St. Paul Completed 1988
 - Wyckoff (East OU) Completed 1994/2001
- Thin layer placement (amendment)
 - KPC Completed 2001

Links for all sites at www.wyckoffsuperfund.com

St. Paul Cap



St. Paul

- **Challenges**

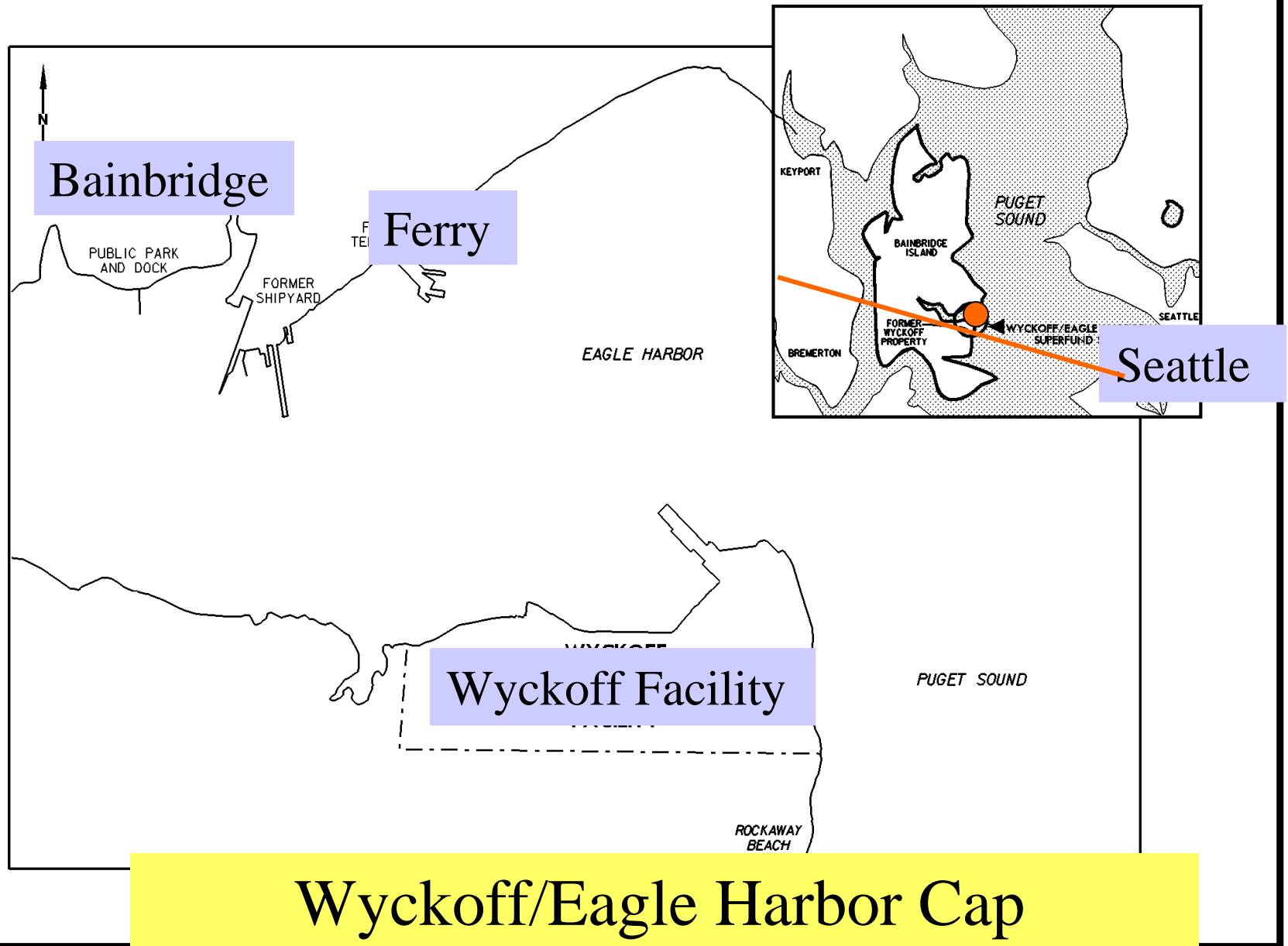
- First regional, large sediment cap at a contaminated site
- Combined cleanup and habitat restoration (intertidal and subtidal)
- Erosion
- Concerns re: mixing of cap and underlying material

- **Solutions**

- Gentle method of placement, shaker box
- Post-cap monitoring for accretion/erosion

St. Paul

- **Success Story**
 - Successful placement of 4 to 20 ft thick cap/mitigation layer; benthic recovery documented; typical mudflat community
- **>10 years of monitoring data**
 - Intertidal visual inspections, bathymetric surveys, sediment deposition monitoring, chemical monitoring (seeps, gas vents, sediment), benthic community structure, algae
 - ***Key Factor*** - statistical analyses of benthic community (recovery occurred within 5 to 7 years)



Wyckoff

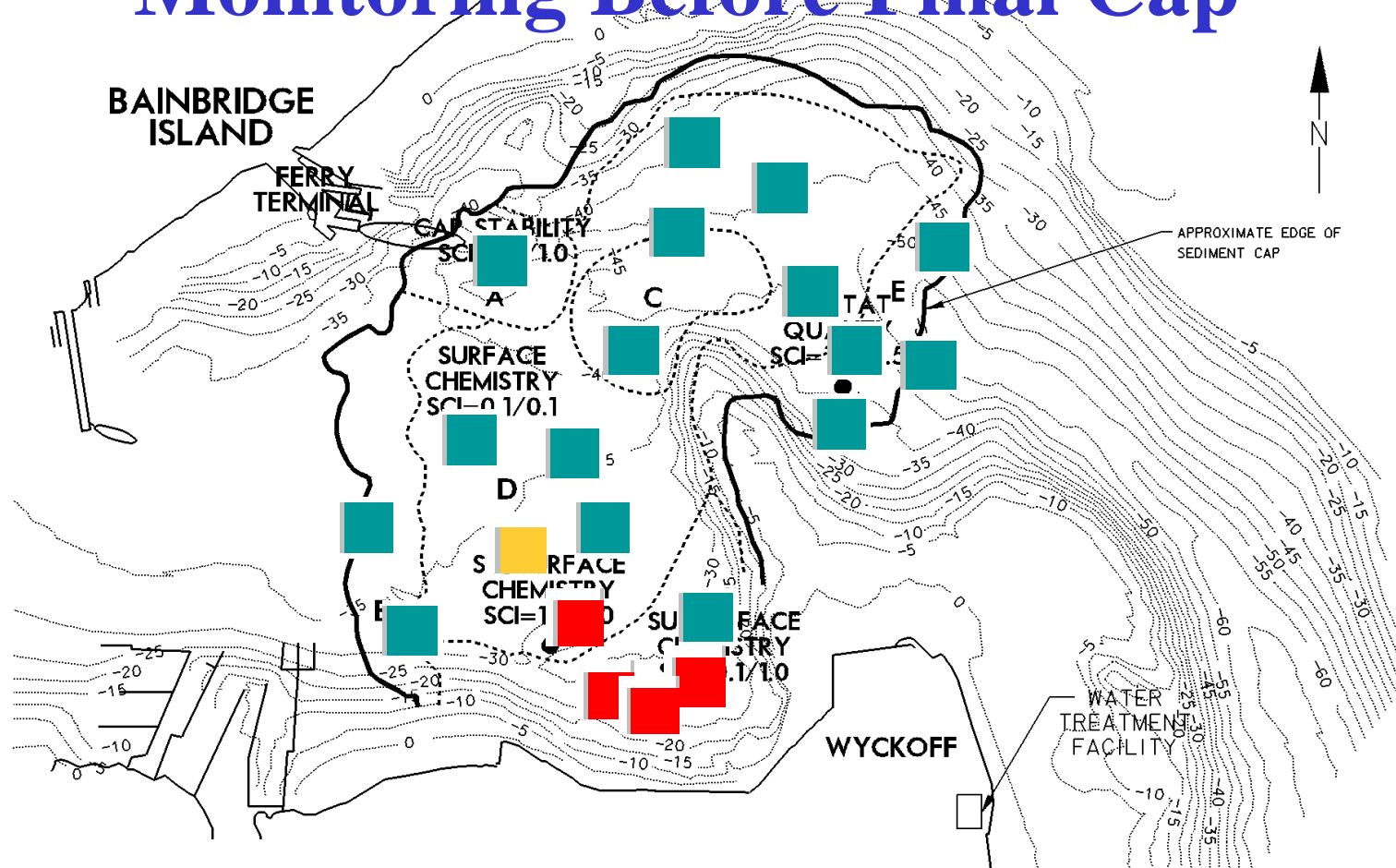
- **Challenges**

- Liquid NAPL; soft sediments; slopes; seismicity

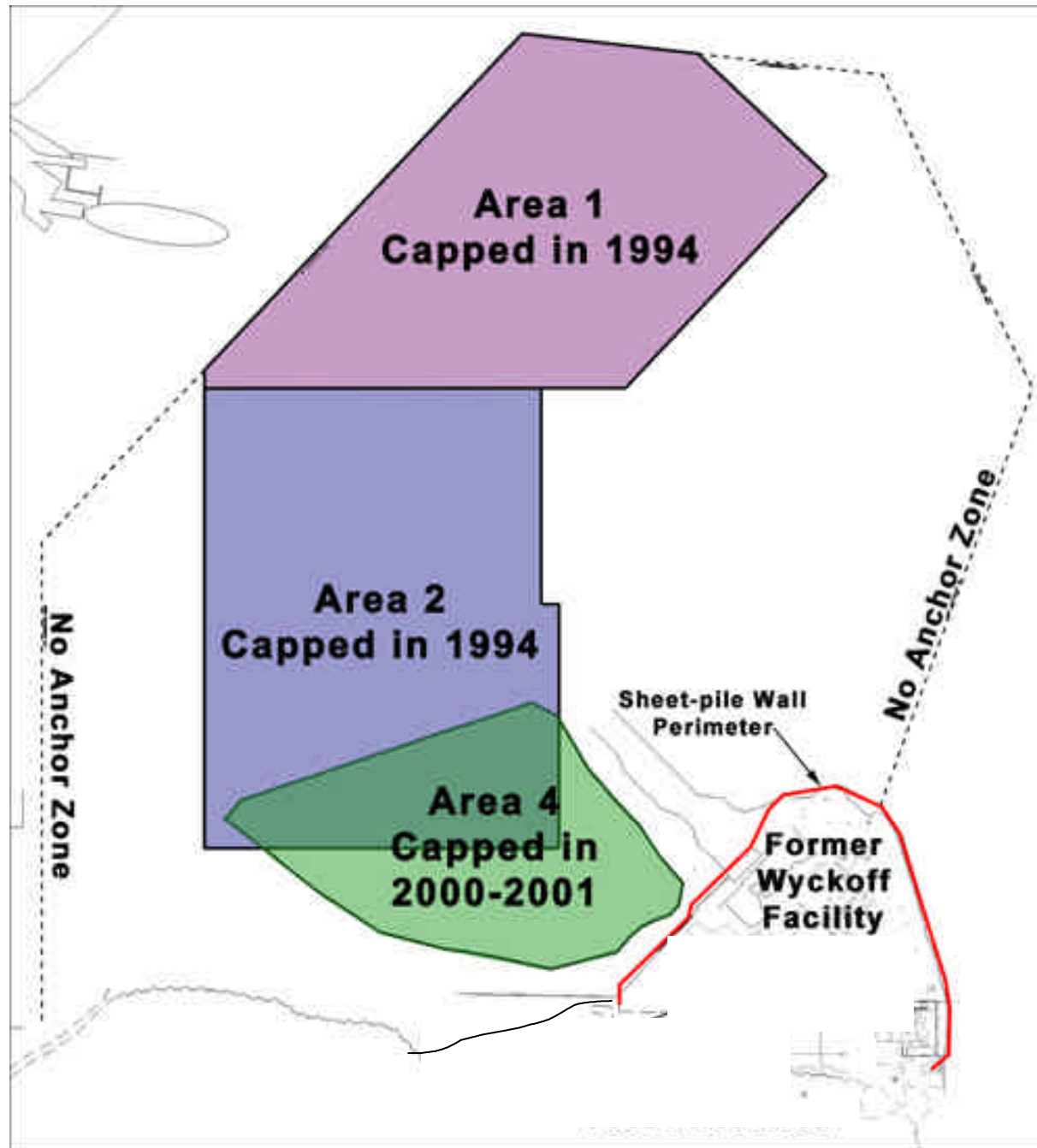
- **Solutions**

- NAPL areas: 3 to 5-ft cap
- Soft sediments/Slopes: barge wash-off placement; variable cap thickness; capping started offshore (2 ft) towards inshore (up to 15 ft thick); displaced sediments moved inshore to thickest cap (natural canyon)
- Seismicity: O&M Plan inspections

Monitoring Before Final Cap



- Worsening or Sustained Low
- Improved or Adequate
- Temporary Biological Depression

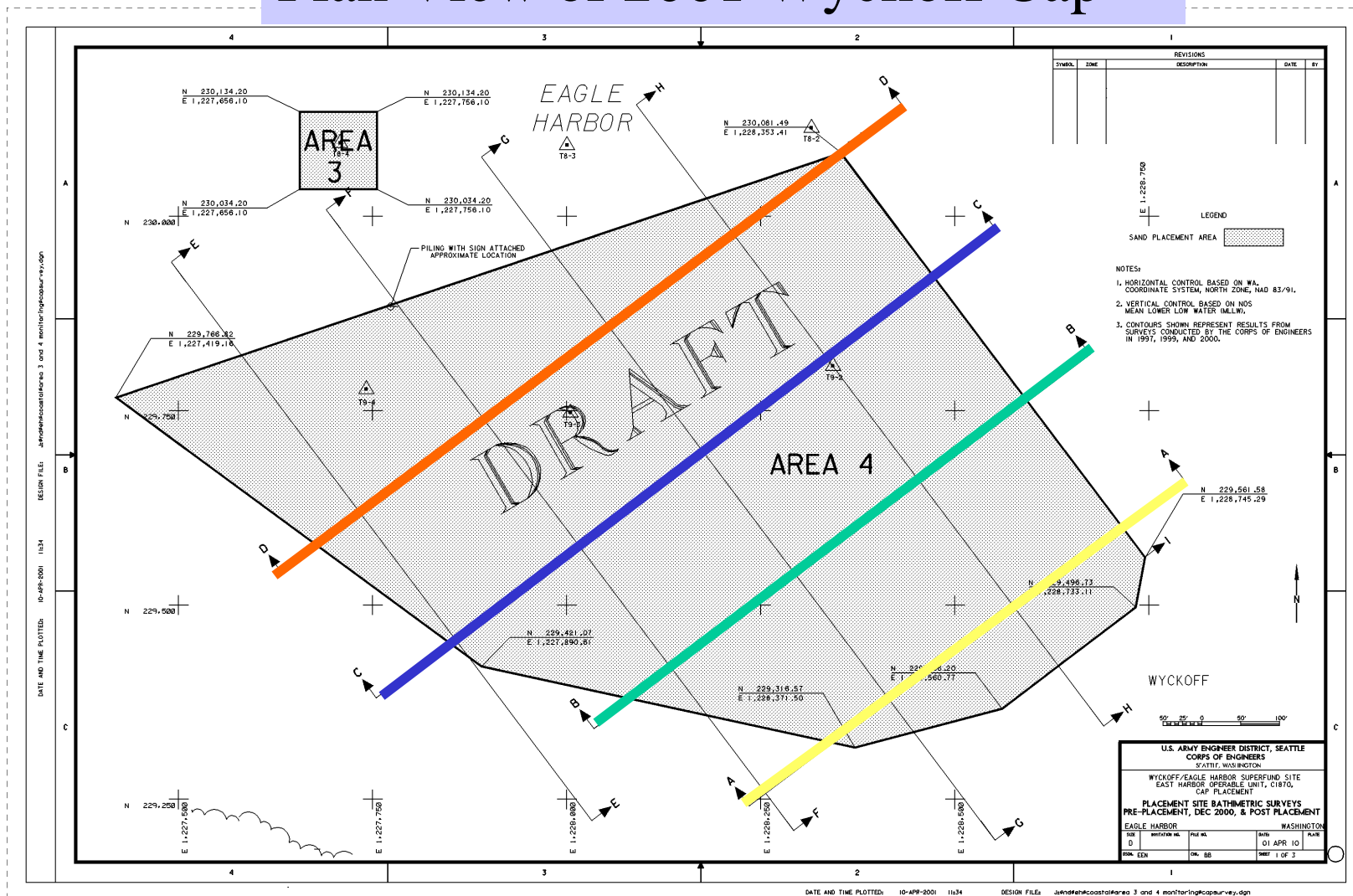


Wyckoff

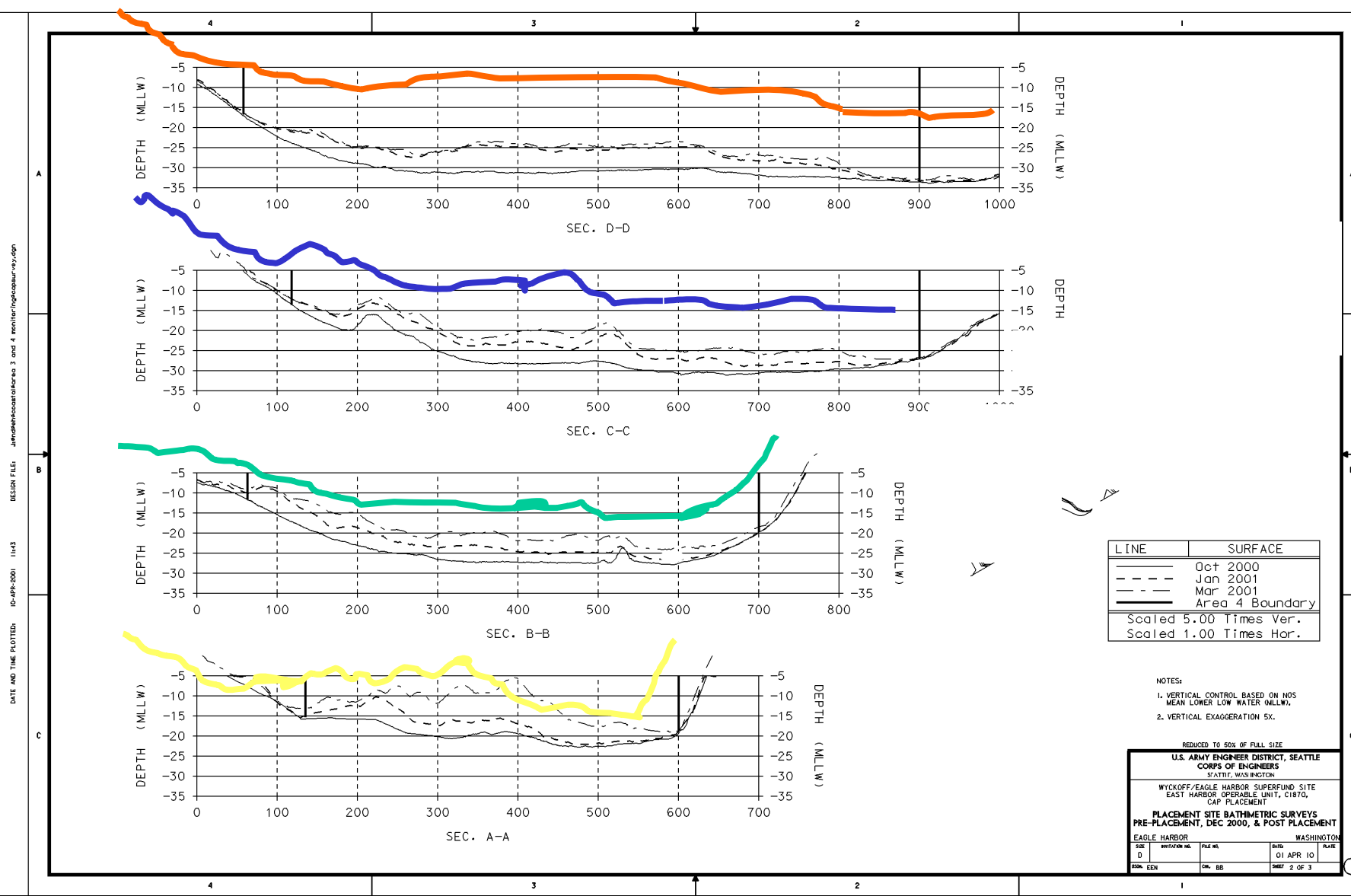
- **Success Story**

- Long-term monitoring data since 1994; new monitoring for “final” remedy ongoing
- Benthic recovery documented and ongoing
- Recontamination from facility continued through 2001, when upland source control was completed
- No evidences of failure due to cap placement or recent 6.8 earthquake
- One release of PAH when capping occurred outside recommended offshore-onshore capping sequence

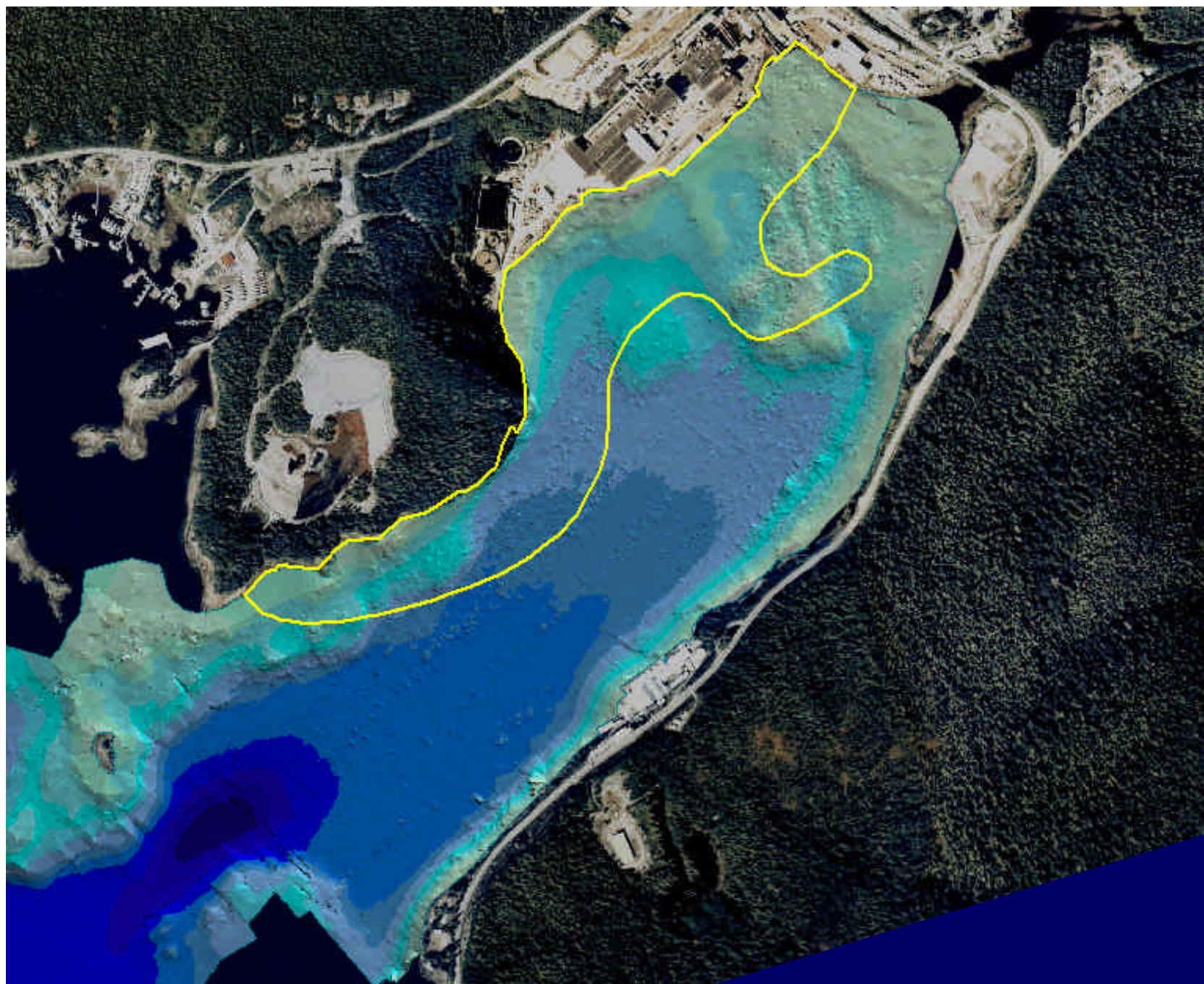
Plan View of 2001 Wyckoff Cap



Cross Sections of Wyckoff 2001 Cap







KPC

- **Challenges**

- Steep slopes (some >40%) and soft sediments (<3 to 20 psf)
- Deep waters (120 ft MLLW max)

- **Solutions**

- Prior to ROD, performed field tests and preliminary engineering tests to improve remedy selection
- Due to pre-design data, was able to “tune” ROD to the site conditions in terms of remedy

KPC

- **Solutions (continued)**
 - Thin layer placement where feasible
 - Capping vs. mounding (RA acceptance areas)
 - 80% coverage as performance standard
 - Monitored natural recovery in areas with:
 - >40 percent slope
 - Very soft (6 psf) and thick (>5 ft) sediments
 - Depths >120 ft MLLW
 - Balance of costs and environmental benefits at greater depths

KPC

- **Success Story**

- 100% successful thin layer placement (no mounding)
- Successful in waters to 120 ft MLLW
- Sediment displacements/admixture with placement layer (*in situ* tests) much less than engineering predictions (shear strength, slope analysis, water content)
- Few instances of WQC exceedances (DO, turbidity)
- Long-term monitoring -- starts in 2004 (sediment chemistry, bioassay, benthos)

Recommendations

- If contemplating a cap, selection of some geotechnical properties that may be collected during the RI: *vane shear, water content, grain size, density*
 - Little extra cost--if planned for (if cap contemplated)
 - Reduces the uncertainty for designers
 - Improves selection of suitable remedy
- Consider physical (slope, depth) and logistical (underpier) constraints
- Some engineering models may not reliably predict success of capping soft sediments

Some Relevant Geotech Parameters

Water content, ASTM D 2216 (or ASTM D 2488-Vis. Classif.)	Key for very soft sediments
Density, ASTM D 2937	Input for both dredging and capping models
Grain Size Distribution, ASTM D 422	% sand & % silt, or use hydrometer for GSD for times when segregation could occur, as in cap material
Atterberg Limits, ASTM D 4318	Helps predict behavior of sediment to be capped
USCS classification, ASTM D 2488 (Includes Water Content)	May permit estimation of other geotechnical characteristics
Specific gravity, ASTM D 854	May be valuable for sediments with wood or organic materials

References for Capping on Slopes and Soft Sediments

- Rollings, Marian, and Raymond Rollings. 1998. Observations on the New York Mud Dump Site. Proceedings of the 15th World Dredging Conference (two papers).
- Nelson, E., A. Vanderheiden and D. Schuldt, 1994. Eagle Harbor Superfund Project, in Proceedings of Dredging 94, 2nd International Conference and Exhibition on Dredging and Dredged Material Placement.
- Design Analysis Report; Ketchikan Pulp Company. 2000. Prepared by Foster-Wheeler Environmental and Exponent.